

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN RE APPLICATION

Box: AF

HEITZ ET AL.

CONFIRMATION No.: 8131

SERIAL No. 10/018,473

GROUP ART UNIT: 1625

FILED: DECEMBER 19, 2001

EXAMINER: TAYLOR V. OH

FOR: CONTINUOUS PREPARATION OF POLYBUTYLENE TEREPHTHALATE FROM
TEREPHTHALIC ACID AND BUTANEDIOL

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BRIEF ON APPEAL UNDER 37 C.F.R. §1.192

Sir:

This is an Appeal from the Examiner's final rejection of Claims 1
to 11, dated October 22, 2003. Claims 1 to 10 are currently pending.

REAL PARTY IN INTEREST:

The real party in interest is BASF Aktiengesellschaft, 67056 Lud-
wigshafen, Germany.

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RELATED APPEALS AND INTERFERENCES:

To the best of the undersigned's knowledge, there are no related
appeals or interferences within the meaning of 37 C.F.R.
§1.192(c)(2).

STATUS OF THE CLAIMS:

The claims on appeal before the Board of Patent Appeals and Interferences are Claims 1 to 10. A copy of these claims is set forth in the attached Appendix.

STATUS OF THE AMENDMENTS:

Claim 7 has been amended and Claim 11 has been canceled under 37 C.F.R. §1.116 (Reply dated December 30, 2003, paper No. 11). The Examiner subsequently issued an Advisory Action (mailed on January 30, 2004, paper No. 12) indicating that appellants' amendment will be entered for purposes of appeal. The claims therefore stand as submitted in appellants' reply of December 30, 2003.

No further amendments have been filed in this application after final rejection.

SUMMARY OF THE INVENTION:

Appellants' Claims 1 to 10 relate to a continuous process for preparing polybutylene terephthalate by reacting 1,4-butanediol and terephthalic acid wherein

- a) terephthalic acid and 1,4-butanediol are directly esterified,
- b) the esterification product obtained in stage a) is precondensed, and
- c) the precondensate obtained in stage b) is polycondensed.

Appellants' invention aims at producing polybutylene terephthalate having a low content of acid and alcohol groups, and specifically at reducing the amount of tetrahydrofuran (THF) and 2,5-dihydrofuran (2,5-DHF) which are formed in the process as by-products¹⁾ to improve the product yield based on the 1,4-butanediol employed in the process²⁾. In accordance with appellants' invention as defined in Claim 1 and further specified in the dependent claims the respective goal is achieved when the esterification stage (a) is conducted in a reactor cascade comprising at least two reactors, wherein

- the reaction pressure decreases along the reactor cascade, and
- the reaction temperature does not increase along the reactor cascade.

1) Inter alia page 2, indicated lines 27 to 33, of the application.

2) Inter alia page 3, indicated lines 4 to 8, of the application.

ISSUE(S) PRESENTED:

Whether the Examiner erred finding that the subject matter of appellants' Claims 1 to 10 was *prima facie* obvious under 35 U.S.C. §103(a) in light of the disclosure of **Braune** (US 5,854,377).

GROUPING OF THE CLAIMS:

For the issue(s) above it is affirmed that Claims 1 to 10 stand or fall together.

ARGUMENTS:

The Examiner's rejection is based on the teaching of **Braune** which relates to a process for the continuous preparation of thermoplastic polyesters such as polybutylene terephthalate³⁾. The respective process comprises⁴⁾

- a) (trans)esterifying the acid and the diol,
- b) precondensing the (trans)esterification product obtained in (a), and
- c) polycondensing the precondensate obtained in (b).

According to **Braune's** disclosure, the process yields in a polyester having a low number of carboxyl end groups⁵⁾ when step (a)

*is carried out in at least two, preferably at least three, temperature zones. The temperature of a subsequent zone should be 1°-40°C, preferably 2°-30°C, in particular 5°-10°C, higher than the temperature of the preceding zone.*⁶⁾

The Examiner takes the position that the reproduced passage of **Braune's** disclosure "*implies that the 1 degree temperature difference is allowable for the esterification stage (a) along the reactor cascade*"⁷⁾.

The implicit teaching which the Examiner asserts to be provided by **Braune's** disclosure requires, however, a specific selection of a

3) Col. 1, indicated lines 6 and 7, in conjunction with indicated lines 48 to 51, of US 5,854,377.

4) Col. 1, indicated lines 4 to 13, of US 5,854,377.

5) Col. 1, indicated lines 52 to 55, in conjunction with indicated lines 59 to 61, of US 5,854,377.

6) Col. 1, indicated lines 62 to 67, of US 5,854,377.

7) Page 6, line 19 to page 7, line 1, of paper No. 10; reproduced page 2, line 18, to page 3, line 1, of paper No. 12.

reactor cascade having exactly two of the "at least two, preferably at least three, temperature zones" referenced by **Braune**, and the combination of that particular reactor cascade with the minimum temperature difference of 1°C between the subsequent, cf. the second, temperature zone and the preceding, cf. the first, temperature zone⁸). The requisite selection and combination relied upon by the Examiner is not deemed to be suggested by the teaching of **Braune** when taken as a whole for what it reasonably conveys to a person of ordinary skill in the art who is unaware of appellants' invention⁹).

When taken for what is reasonably conveyed to a person of ordinary skill, the teaching of **Braune** provides that the esterification stage (a) is to be conducted in at least two, preferably at least three, zones of different temperatures. Bearing in mind that the numbers two and three are minimum amounts of temperature zones, a person of ordinary skill would conclude that the higher temperature differences between two temperature zones apply where the reactor cascade encompasses a low number of temperature zones whereas the lower temperature differences between two temperature zones are applicable where the reactor cascade encompasses a high number of temperature zones. The respective interpretation of the teaching of **Braune** provides that the overall temperature difference which exists between a first and a last temperature zone of the reactor cascade is essentially equivalent for a set-up having three temperature zones and a set-up which has more than three temperature zones.

The foregoing interpretation of the teaching of **Braune** is supported by the representative examples which illustrate **Braune's** set-up of temperature zones for stage (a)¹⁰). It is in this context respectfully noted that the Examiner's summary¹¹) of the experimental conditions applied by **Braune** does not summarize the conditions ap-

8) Where a selective combination of the prior art is necessary to render a claimed invention obvious, there must be some reason for the specific combination other than hindsight obtained from the claimed invention. Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 227 USPQ 543 (CAFC 1985).

9) "It is difficult but necessary that the decisionmaker forget what he or she has been taught ... about the claimed invention and cast the mind back to the time the invention was made (...), to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art." W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303, 313 (CAFC 1983), cert. denied, 469 U.S. 851 (1984).

10) Col. 5, indicated line 27, to col. 6, indicated line 40, of **US 5,854,377**.

11) Page 5, line 26, to page 6, line 13, of paper No. 10.

plied in stage (a) of **Braune's** examples¹²⁾. In Example 1¹³⁾, **Braune** employs for stage (a) a cascade comprising three temperature zones, the respective temperatures being 225°C, 230°C and 235°C, corresponding to a temperature difference between the first and the last temperature zone of 10°C. The pressure is 1 bar in each zone, and the residence time is 125 min, 60 min and 20 min¹⁴⁾, respectively. Stage (a) in Example 2¹⁵⁾ of **Braune** is also conducted in a cascade comprising three temperature zones. While the pressure and residence times are identical to the conditions applied in Example 1, the temperatures of the temperature zones are here 180°C, 190°C and 205°C¹⁶⁾, respectively, corresponding to a temperature difference between the first and the last temperature zone of 25°C.

When the data which are compiled in **Braune's** table¹⁷⁾ are compared¹⁸⁾ it is noticeable that the more desirable lower number of carboxyl end groups is achieved under the conditions of Example 2 where the temperature was increased along the reactor cascade by a total of 25°C.

The Examiner's argument that **Braune's** disclosure "implies that the 1 degree temperature difference is allowable for the esterification stage (a) along the reactor cascade" is based on a specific selection of minimum values, and a combination of those minimum values. The respective selection and combination is, however, not made for reasons apparent from the teaching of **Braune** or for any reasons which are apparent in light of the general technical knowledge available to one of ordinary skill in the art at the time appellants made their invention¹⁹⁾. Rather, the Examiner's selection is guided by the requirements which characterize appellants' process and is, there-

12) Stage (a) of Examples 1a) and 1b) is addressed in col. 5, indicated lines 29 to 39, of *US 5,854,377*.

13) Examples 1a) and 1b) of **Braune** differ in the conditions applied in stage (c), note col. 5, indicated line 57, to col. 6, indicated line 6, of *US 5,854,377*.

14) Col. 5, indicated lines 34 to 36, of *US 5,854,377*.

15) Examples 1a) and 2a) of **Braune** differ in the set-up of the temperature zones. Compare col. 5, indicated lines 34 to 36, and col. 6, indicated lines 12 to 15, of *US 5,854,377*.

16) Col. 6, indicated lines 10 to 15, of *US 5,854,377*.

17) Col. 6, indicated lines 31 to 40, of *US 5,854,377*.

18) The sole difference between Examples 1a) and 2a) is the set-up of the temperature zones in stage (a). The same applies when Examples 1b) and 2b) are compared.

19) The Examiner has not pointed to any rationale which would motivate a person of ordinary skill in the art to make the particular selection and combination on which he relies in the rejection.

fore, based on hindsight²⁰⁾. The Examiner's respective position and the Examiner's conclusion that "there is little difference as to conducting the actual reaction process regardless of the slight reaction temperature variations" and "there is no patentable weight in this limitation^[21)] over the prior art"²²⁾ is therefore deemed to be in error.

The Examiner states that "under the 103 rejection, the Examiner compares the current invention with the prior art as to how similar they are to each other"²³⁾. However, ascertaining the differences between the prior art and the claims at issue requires that both the invention and the prior art reference(s) are considered as a whole²⁴⁾, and the question under 35 U.S.C. §103 is not whether the differences themselves are minor and would therefore have been obvious, but whether the claimed invention as a whole would have been obvious²⁵⁾.

In determining whether the invention as a whole would have been obvious under 35 U.S.C. 103, we must first delineate the invention as a whole. In delineating the invention as a whole, we look not only to the subject matter which is literally recited in the claim in question... but also to those properties of the subject matter which are inherent in the subject matter and are disclosed in the specification... Just as we look to a chemical and its properties when we examine the obviousness of a composition of matter claim, it is this invention as a whole, and not some part of it, which must be obvious under 35 U.S.C. 103.^[26)]

Accordingly, appellants' invention as a whole not merely resides in that the reaction temperature does not increase along the reactor cascade which is employed in stage (a) of the process, but also in

20) Id. ftn (9), page 4 of this paper; note also Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 230 USPQ 303, 312-313 (CAFC 1983): "To imbue one of ordinary skill in the art with the knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein which only the inventor taught is used against the teacher."

21) Cf. appellants' requirement that the reaction temperature does not increase along the reactor cascade which is employed in stage (a) of the process.

22) Page 7, lines 1 to 4, of paper No. 10; reproduced on page 3, lines 1 to 5, of paper No. 12.

23) Page 3, lines 3 and 4, of paper No. 12.

24) Hodosh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (CAFC 1986).

25) Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 218 USPQ 871 (CAFC 1983); Hybri-tech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 USPQ 81 (CAFC 1986), cert. denied, 480 U.S. 947 (1987).

26) In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8 (CCPA 1977); emphasis original, citations omitted.

the property that the amount of undesired tetrahydrofuran (THF) and 2,5-dihydrofuran (2,5-DHF) by-products is reduced which is inherent in the combination of requirements recited in the claims and is disclosed in the specification²⁷⁾).

The teaching of **Braune** not only fails to suggest or imply a process wherein the temperature in the reactor cascade in stage (a) does not increase, it also contains nothing which suggests or implies that the way in which the temperature is adapted in stage (a) has an impact on the amount in which the unwanted by-products THF and 2,5-DHF are formed. The teaching of **Braune** is therefore not deemed to be sufficient to render appellants' invention "as a whole" *prima facie* obvious.

The Examiner takes the position that appellants' claims are unrelated to reducing the amount of unwanted by-products and that appellants' respective argument is, therefore, irrelevant²⁸⁾, explaining "[i]t is the PTO's policy that applicants are only protected by what they claim in the invention, not what they describe in the specification"²⁹⁾. To the extent that the Examiner's remarks indicate that the determination (non)obviousness pursuant to 35 U.S.C. §103(a) is made without consideration of the properties of, and the problem which is solved by, the invention, the Examiner's position is deemed to be in error³⁰⁾.

C O N C L U S I O N

In light of the foregoing, it is respectfully requested that the Examiner's rejection of appellants' Claims 1 to 10 as being rendered *prima facie* obvious under 35 U.S.C. §103(a) by the disclosure of **Braune** be reversed. Favorable action is solicited.

27) The respective property of appellants' process is inter alia illustrated in the experimental section of the application, particularly by the data compiled in cols. 2 to 7 of Table 1, page 11 and 12, of the application.

28) Page 9, lines 1 to 5, of paper No. 10.

29) Page 3, lines 9 and 10, of paper No. 12; emphasis original.

30) "[I]t is the invention as a whole that must be considered in obviousness determinations. The invention as a whole embraces the structure, its properties, and the problem it solves" In re Wright, 848 F.2d 1216, 6 USPQ2d 1959 (CAFC 1988).

REQUEST FOR EXTENSION OF TIME:

It is respectfully requested that a one month extension of time be granted in this case. A check for the \$110.00 fee is attached.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 11.0345. Please credit any excess fees to such deposit account.

Respectfully submitted,

KEIL & WEINKAUF



Herbert B. Keil

Reg. No. 18,967

1350 Connecticut Ave, N.W.
Washington, D.C. 20036
(202) 659-0100

Encl.: THE CLAIMS ON APPEAL (Appendix I)

HBK/BAS

A P P E N D I X I:

THE CLAIMS ON APPEAL:

1. (*previously presented*) A process for the continuous preparation of polybutylene terephthalate from terephthalic acid and 1,4-butanediol, comprising:
 - a) direct esterification of terephthalic acid with 1,4-butanediol in a reactor cascade comprising at least two reactors,
 - b) precondensation of the esterification product obtained in stage a), and
 - c) polycondensation of the precondensate obtained in stage b),wherein the reaction pressure decreases and the temperature does not increase along the reactor cascade in stage a).
2. (*original*) A process as claimed in claim 1, wherein the esterification in stage a) is carried out at pressures of < 1 bar.
3. (*previously presented*) A process as claimed in claim 1, wherein, in a reactor cascade comprising three reactors, the pressure in the first reactor (p1) is < 1 bar, the pressure in the second reactor (p2) is < p1 - 100 mbar and the pressure in the third reactor (p3) is < p2.
4. (*previously presented*) A process as claimed in claim 1, wherein the esterification stage a) is carried out at from 170 to 250°C.
5. (*previously presented*) A process as claimed in claim 1, wherein the molar ratio of 1,4-butanediol to terephthalic acid at the beginning of stage a) is from 1.1:1 to 3.5:1.
6. (*previously presented*) A process as claimed in claim 1, wherein the conversion after the last reactor of stage a) is > 97%, based on terephthalic acid, before the precondensation in stage b) commences.
7. (*previously presented*) A process as claimed in claim 1, wherein the direct esterification stage a) is carried out in the presence of tetrabutyl orthotitanate as a catalyst.
8. (*previously presented*) A process as claimed in claim 1, wherein the precondensation stage b) is carried out at temperatures from 220 to 300°C and pressures in the range from 0.05 bar to the esteri-

fication pressure in the last reactor of the reactor cascade of stage a).

9. (*previously presented*) A process as claimed in claim 1, wherein the precondensate obtained in stage b) is polycondensed in stage c) at from 240 to 290°C and pressures of from 0.2 to 20 mbar.
10. (*original*) A process as claimed in claim 9, wherein the polycondensation is continued until the polycondensate obtained has an acid number of < 50 meq/kg.